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HERBERT SPENCER'S AUTOBIOGRAPHY.*

THE autobiography of a great man, the publication of which during his lifetime is expressly interdicted by him, unavoidably raises the question as to the possibility of disinterested action. Mr. Spencer has, indeed, in his 'Autobiography' discussed the motives that prompted his work, and has shown that egoism and altruism are inextricably mixed in the composition of these motives. But he speaks only of his philosophical works, all of which appeared during his lifetime, and in which he may, therefore, be supposed to have a personal interest. But here is a work of no mean proportions, in which he knew he could take no interest after it appeared. In many cases the motive may be explained by the belief on the part of the authors that they will continue to exist and remain cognizant of all that is to take place, and will, therefore, know just what the effect of their action is to be upon the world at large. But no such motive can be alleged in the present case, for he himself says: 'as I have no belief in anything to be gained in another world, it can not be otherworldliness that moved me'; and again: 'with death there lapses both the consciousness of existence and the consciousness of having existed.' This is not the place to discuss such a question, but in the minds of many it can not be suppressed.

The 'Autobiography' of Herbert Spencer must not be regarded as a mere pastime and incidental episode in his career, but as

* Two volumes. New York, D. Appleton and Company, 1904, 8°.

an integral part of his life work. Whereas his other works constitute his philosophy of nature, his 'Autobiography' constitutes his philosophy of life. It is a large work, seriously written, costing him years of labor. It was not written after his main work was done as a closing retrospect to his laborious life, but was executed in the midst of his busiest days, while he was hard at work on his 'Synthetic Philosophy.' It was begun, he tells us, in May, 1875, *i. e.*, while he was writing the first volume of his 'Principles of Sociology,' and the main portion of it was finished on his sixty-ninth birthday, April 27, 1889, or while he was writing the first volume of his 'Principles of Ethics.' It is true that four years later he wrote some 'Reflections,' which occupy the last sixty pages of the 'Autobiography,' in which some of the events of that period are alluded to, but this is not, like the rest, a chronological record. But even if we place the conclusion of this work at the year 1893, which is the date of the second volume of the 'Principles of Ethics,' we find that it ended before the appearance of either of the last two volumes of the 'Principles of Sociology,' although parts of the second volume had been published. The third volume bears date, 1897. There were then still four years of activity after the last word of the 'Autobiography' had been dictated before the conclusion of the 'Synthetic Philosophy.' He survived his great work six years, and there are evidences that he was by no means idle during that time. In a letter dated May 4, 1897, although he characterizes himself as a 'wreck,' still he speaks somewhat doubtfully of his ability to complete his "remaining task—revision of the 'Principles of Biology.'" Why he did not bring his 'Autobiography' down to some such date, or even later, has not yet been explained.

This work has done the important service of dispelling a large amount of popular error with regard to Herbert Spencer's life and career. The prevailing opinion has been that he was a typically 'self-made man.' He has been represented as having had to struggle with adversity, and has been held up as a proof of the theory that great abilities are certain to assert themselves whatever the obstacles may be in their path. His life shows that, on the contrary, he was highly favored by circumstances. While of course without his talents his achievements would have been impossible, still, given such talents, there was scarcely any reason why he should not have accomplished great things. He does not himself favor the Galtonian doctrine, but fully recognizes his indebtedness to circumstances. He admits that but for the three legacies that were one after the other left him by his two uncles and his father, he could never have completed his system. But he was even more indebted to the help of influential friends, freely volunteered, and by a whole train of favorable circumstances, fully set forth in his 'Autobiography.' Indeed, his very environment was sufficient to bring out all that was in him. On intimate terms for the greater part of his life with such men as Huxley, Tyndall, Hooker, Lubbock, Mill, Lewes and Bain, belonging to the same clubs, taking long walks, and having constant discussions with them, the stimulus must have been enormous.

He enters quite elaborately into the question of genealogy, and shows that his ancestors embodied extremely heterogeneous elements, elements, as he maintains, calculated to implant in him most of the characteristics that he possessed. To a groundwork of immemorial English and a little Scotch there was added a strain of the French Huguenot, probably tinctured with Bohemian Hussite protestantism. It must not, however, be supposed that this ancestral heterogeneity rendered him any the

less typically English, for the one leading characteristic of the whole Anglo-Saxon race is the complete mixture of all the numerous races—Saxon, Danish, Norman, British, Welsh, Scotch, etc.—that entered into the composition of the later inhabitants of that historic isle.

Herbert Spencer is commonly represented as being the type of a self-educated man. Nothing could be farther from the truth. The son of a professional teacher belonging to a long line of teachers, he was surrounded by educational influences from his very birth. So far from struggling to educate himself, his main efforts as a boy seem to have been to escape from the perpetual drill of the domestic school. His father finally sent him away to be further drilled by his uncle, but it was the same old story, geometry forever. His youthful escapade from this latter educational treadmill is very amusing. Many boys of some pluck, when they imagine themselves ill-treated at home, 'run away,' but Spencer, thinking himself overtasked by his uncle, *ran home,* from Hinton to Derby, a distance of nearly 150 miles! He admits that it was largely homesickness, and one can compare it to nothing but the way a domestic animal, removed from the spot to which it has become wonted, will seize the first opportunity to go back, regardless of the distance, and guided by that little-known 'sense of direction' that some think to be located in the semicircular canals of the ear.

But whatever his treatment may have been, and it certainly was never severe, Herbert Spencer as a boy was always being taught. His education was not sporadic and one-sided, but methodical and all-sided. He is usually represented as wholly ignorant of Greek or Latin and of modern languages. In so far as this is true it was due to his distaste for them, for he complains of being taught them. At that day, before the natural sciences had come to receive the place they now occupy in education, all pupils belonged to one or the other of two classes, those that loved mathematics and hated languages, and those that loved languages and hated mathematics. Spencer belonged to the first of these classes. But he had to learn languages and dead languages at that, and any close observer of his style can see that he did learn them sufficiently to affect his style. It is clear that he always had the derivation of a word in mind when using it, and that he knew enough Greek and Latin to apply their principles to his own language. He seems to have known very little German, but he not only read French, but spoke it well enough to act on one occasion as an interpreter.

All that is left, therefore, of the prevailing notion about his education is that he was not university trained. He thought that a great advantage, and never tired of citing proofs that university training spoils a man for all usefulness and fills him with a mass of useless rubbish. Whether he would have done any better or worse had he taken a university course may be a difficult question to answer, but his whole reasoning on the subject is unsound because it is based on the exceptional man and takes no account of the average man. Indeed, his entire philosophy of education is permeated by this vice. His book on education may be said to rest on the assumption that every child has a father or a mother or both capable of properly educating him or her. One has only to look around to see how absurd this assumption is.

Herbert Spencer belonged to the middle class; though not rich, he was by no means poor. He never did manual labor of any kind, and none of his ancestors at all recent belonged to the laboring classes. He explains the smallness of his hands by this

fact. He never knew what it was to be in want or to fear that he might come to want. The only work of a bread-winning kind that he ever did was while serving as a civil engineer in the construction of certain railroads. This occupied nine years of his life (1837–46), from his seventeenth to his twenty-sixth year. The several positions that he held during this time were not sought, but were offered to him, generally, as he admits, through the influence of his friends rather than from any superiority of his own in the business. More than once he gave up a good position and returned home for awhile. But his father's latch-string was always out and he was welcomed back whatever might be the cause of his coming. He alleges as one reason for not holding his positions longer, his 'lack of tact in dealing with men, especially superiors,' and says: "Advancement depends rather on pleasing those in authority than on intrinsic fitness. * * * Never did it enter into my thoughts to ingratiate myself with those above me. Rather I have ever been apt, by criticisms and outspoken differences of opinion, to give offense." In other words, he was no toady, and never cared to 'crook the pregnant hinges of the knee where thrift may follow fawning.' But he was never removed from any position. He always voluntarily quit work, usually with the regret of his employers.

The only other period of his life that he was subject, even nominally, to the will of a superior was during the five years (1848–53) that he was sub-editor of the *Economist,* and this position he also voluntarily relinquished. This was an easy position and left him much leisure time, as may be judged from the fact that during this period he wrote his first book, 'Social Statics.' It was to be hoped that in his 'Autobiography' he would give a full explanation of how he came to choose the title 'Social Statics.' He does, indeed, discuss a number of titles that had occurred to him, but leaves it to be assumed that the one finally adopted was originally his own. To find the true explanation it is necessary to go to the revised edition of that work published in 1892, where in a footnote to page 233 he says he met with the phrase in Mill's 'Political Economy,' Mill himself crediting it to another writer, which other writer, though Spencer did not know it, was Auguste Comte. It thus happens that, notwithstanding his strenuous efforts to disclaim all influence of Comte, three of the leading terms of his philosophy, *social statics, sociology* and *altruism,* were Comtean terms.

After leaving the *Economist* he devoted himself for a time to article writing, which yielded him some revenue, though scarcely a livelihood, but which had the advantage of enabling him, as Nietzsche would say, to get rid of his thoughts. Instead, however, of getting rid of them, he found them taking complete possession of him. In fact, the very next year (1854) he commenced writing his 'Principles of Psychology,' which he finished within a year, and the work actually appeared in 1855. But even this, so far from satisfying him, served only the more completely to open up the vista of his future, and although he characterized the next two years as 'idle,' before the end of 1857 a great system of philosophy had taken shape in his mind. His first rough draft of its main heads was made and dated January 6, 1858. Two years later the complete prospectus was issued, and this was adhered to in most particulars during the subsequent thirty-seven years of its execution.

He had now made his plans known to all his friends and they had unanimously encouraged him to proceed. The great obstacle was publication, as no publisher would undertake so hazardous a work, and after much discussion and advice it was

decided to issue the work in parts by subscription. In one of the appendices to the 'Autobiography' appears the list of original subscribers. We may judge of the backing that he had, even at the outset, by the following names that are found among others in that list: John Stuart Mill, Charles Darwin, Thomas Huxley, Sir Charles Lyell, Sir Joseph Hooker, Sir John Herschel, Professor De Morgan, George Henry Lewes, George Eliot, Charles Kingsley, George Grote, Alexander Bain, Henry T. Buckle, Jules Simon.

It is interesting to compare the original draft with the final draft of the prospectus of Mr. Spencer's system. Aside from the difficulty of explaining why he called both parts of Vol. I. ('First Principles') the 'Unknowable' in the former, while Part II. in the latter deals with the 'Knowable,' there is the fact that in the original draft he makes Part III. treat of 'Astronomic Evolution' and Part IV. of 'Geologic Evolution,' these being the 'two volumes' that were wholly omitted in the completed system. As this original draft was never before published the world was left practically in the dark as to what these volumes would have contained had they been written. In the explanatory note inserted in the preface to 'First Principles' (p. xiv) he simply states that the application of these principles to inorganic nature is omitted, but this gives no intimation as to how this application would have been made. He does, indeed, refer in at least two other places to these omitted volumes ('Principles of Biology,' Vol. I., Appendix, pp. 479, 480; 'Principles of Sociology,' Vol. I., p. 3), and in the second of these he says that one of the volumes would have dealt with 'Astrogeny' and the other with 'Geogeny.' These appear to be the only hints that he gave out on this point, and few readers probably ever noticed them. But in one of his letters written in 1895 he entered much more fully into this subject and set forth clearly just what his whole system would have been had it been fully written out.*

The rest of the 'Autobiography' deals mainly with the execution of this great scheme, which need not be followed out. There are, however, many incidental matters connected with the chief matter, and some not connected with it, that have a special interest. Only a few of these can be mentioned. One of these relates to the reception that Mr. Spencer's books met with at the hands of the public. Nothing certainly is more annoying to a writer on philosophical subjects than the reviews of his books. As Spencer says, "adverse criticisms of utterly unjust kinds frequently pursue the conscientious writer. * * * Careless misstatements and gross misrepresentations continually exasperate him." He finally discovered that reviews do more harm than good. An author is lucky if no attention is paid to his books, for it is far better to be 'smothered with silence' than to be willfully or ignorantly misrepresented. A reviewer who has not the caliber to understand a book, but who must, nevertheless, review it because it is sent to the press, will usually indulge in cheap flings at it and apply to it damaging epithets calculated to deter readers from examining it. If it seems radical or opposed to current ideas it will arouse 'offended prejudices' or call down the *odium theologicum*. Everybody knows how Darwin's works were treated by the religious press. Then there is the subsidized press, which maintains a strict censorship over the contemporary literature, more effective in some respects than that of despotic governments, and every book that is suspected of being at all 'dangerous' is attacked by the leading journals, sometimes with ridicule, some-

* See SCIENCE, N. S., Vol. III., February 21, 1896, p. 294; 'Pure Sociology,' pp. 67–69.

times with apparent seriousness, usually by scholarly writers employed for the purpose. Even specialists can always be hired to write books down.

Mr. Spencer found that the sale of his books was being seriously interfered with through hostile reviews. Professor Bain, who was one of the subscribers, told John Stuart Mill that for a long time he did not read 'First Principles,' saying "that the impression gained from notices of it had deterred him. He went on to say that when, subsequently, he read the book he found to his astonishment that the reviews had not given him the remotest conception of its contents." It was, therefore, decided to send no more copies to the press, and this policy was adhered to until near the end of the work. After it had been fairly tested it was found on examining the accounts that the sales had about doubled.

As already remarked, Mr. Spencer was now beholden to no man and could devote all his energies to his great task. But he was destined to become a slave to a worse master than any superior officer. He was to become the victim of an insidious disease, a disease which proved incurable, and which attacked precisely the organ of which he had the greatest need—his brain. It began with insomnia, and was always attended with insomnia, but it soon threatened complete prostration, and from his thirty-fifth year to the end of his life it was one constant struggle for health. But it was not a fatal disease, as he lived well into his eighty-fourth year, and, as he says, it was not a painful disease, and, like most forms of neurasthenia, it did not show in his face, so that people always supposed him younger than he was. But it rendered continuous attention to anything whatever impossible. His work must henceforth be done at short sessions with long intervals of rest. There were sometimes days, weeks and even months that he could do nothing. In the pursuit of health he traveled much and resorted to all forms of amusement. Fishing was his favorite pastime, but he often took long pedestrian journeys.

He must have been a very poor observer. It would seem that he had subordinated and practically sacrificed his perceptive to his reflective faculties. With even the little dips into entomology, botany and geology that he had made in his early life, one would suppose that he would have seen more in the world. But he rarely mentions any object in natural history. It is very disappointing to read his account of walks, for example, round the Isle of Wight. He does, indeed, mention the chalk, but he never mentions the far more interesting Wealden formation, and seems to have had no idea of the geology of that island. It was the same with his visits to the Yorkshire coast and other places celebrated for their geological interest. But he observed men and human operations, and usually criticizes everything severely. Nothing in art, ancient or modern, came up to his ideal.

Herbert Spencer, as all know, never married, and it seems certain that his celibacy was the result of a reasoned resolve to let nothing interfere with his main purpose. But it is evident from reading his 'Autobiography' that he was not lacking in any of the qualities that would have made family life successful. He often alludes to it as a good that he was compelled to forego. His views of women were of the most enlightened kind, and the ideal of marriage that he sets forth in a letter to a friend about to marry is as perfect and noble as it is possible to conceive of. There are doubtless many readers for whom the most interesting part of his 'Autobiography' will be that which treats of his relations with George Eliot, although, so far as can be judged either from this work or from the 'Life and Letters of George

Eliot,' these relations were never in any sense sentimental. But they were certainly much more intimate and more prolonged than any of her letters would lead us to suppose. It is surprising to learn that it was he chiefly who urged her to write fiction, an idea which she could not at first entertain. The 'Letters' leave the impression that it was Lewes who played this rôle. Perhaps both equally saw in her this talent before she saw it in herself. It is equally surprising that she should have made Spencer her confidant in the matter of the authorship not only of her first stories, but also of 'Adam Bede.' It is to be regretted that she, too, did not write an autobiography.

Such is a hasty glance at a few of the salient points in the 'Autobiography' of Herbert Spencer. No two persons would select the same points, and no such glance can hope to do justice to the work. Nothing has been said of his inventions, which were numerous but none of them important or successful; of his numerous essays, from his 'Proper Sphere of Government' to his 'Factors of Organic Evolution'; of his 'Descriptive Sociology,' that monumental but costly undertaking; of his 'cerebral hygiene,' which, unlike that of Comte, consisted in reading nothing that he did not agree with, thus warping, as Comte had dwarfed, the growth of ideas; of his more extended travels, including his visit to America, which latter is familiar to us all; nor of his persistent hostility to governmental initiative (*laissez faire*), which formed so prominent a feature in his political philosophy.

With regard to this last it would seem that owing to preconceptions of his youth confirmed during his connection with the *Economist*, he was unduly frightened by the bugbear of collectivism, which is really nothing but social integration, and a necessary part of the very social evolution which he taught. For this must consist, as in both inorganic and organic nature, of differentiation and integration. His inability to perceive this made his system, so broad at its base, a frustum instead of a pyramid.

The 'Autobiography' is written in a much more pleasing style than his other works. It shows its author in all the simplicity of true greatness. His life demonstrates that he was a natural product of his time. He lived at the acme of the Victorian age, the grandest epoch in history, and he was directly in touch with all the powerful forces that characterized that epoch. When we take into consideration his own inherent powers we may say in very truth that his life was 'a continuous adjustment of internal relations to external relations,' and that he was a normal product of the laws of evolution that he expounded.

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THE WORK OF THE YEAR 1903 IN ECOLOGY.*

AN apology for this paper is necessary and will be forthcoming. The task outlined in the title is by no means voluntary, but has been imposed upon the speaker by your relentless committee; and this—as the secretary will acknowledge—in spite of the speaker's urgent protest. It is always impossible to give a critical summary of current events, because all of us are afflicted with the disease of contemporary blindness. It is more than impossible to do such a task for the field of ecology, since the field of ecology is chaos. Ecologists are not agreed even as to fundamental principles or motives; indeed, no one at this time, least of all the present speaker, is prepared to define or delimit ecology. It is, therefore, a

* Read by invitation of the sectional committee, Section G, American Association for the Advancement of Science, at the St. Louis meeting, December 29, 1903.

certainty that this hasty review will put emphasis where subordination or oblivion is better, and will notice slightly or not at all researches which will loom up in the future. Many titles which the speaker thinks important have been left out from lack of space and time.

If ecology has a place at all in modern biology, certainly one of its great tasks is to unravel the mysteries of adaptation. Are the many structures of animals and plants, which are obviously of use, fundamental or accidental in an evolutionary sense? The Darwinian and Lamarckian theories, which have almost totally replaced the gross teleology of former days, have usually been supposed to imply an evolutionary relation between an organ and its use. The Lamarckians have emphasized the direct response of organism to environment, and the inheritance of useful acquired characters. The Darwinians have emphasized the gradual 'working out' of highly useful structures by the influence of selection upon small fluctuating variations. The two theories are not necessarily inharmonious; the Lamarckians have inquired more as to the origin of variations, the Darwinians as to their survival. The publication of DeVries's mutation theory has occasioned a sharp change of front in many quarters. We hear more now than formerly of adaptation as a secondary thing; that it has little or no significance in an evolutionary sense. The idea that an organ is not explained when we assign it a function is not new; Geoffroy St. Hilaire made this one of the cardinal points of his evolutionary philosophy nearly a century ago, and we find the Greek philosophers debating the question in their day.

Professor Morgan's 'Evolution and Adaptation' has called the adaptation question once more to the fore. Morgan holds that the mutation theory accounts best for incipient organs, now useless, but eventually to become useful when fully developed, for organs that are wholly useless, and for 'over-adapted' organs (such as electric organs in fishes, leaf movements of *Desmodium gyrans*). Many organs that are useless or even harmful may survive because the organism may have some compensatory advantages making it as a whole well adapted. Another whose work tends to entice us from our former idols is Klebs, whose 'Willkürliche Entwicklungsänderungen' is certainly one of the great contributions of the year. Klebs is removed as far as possible from teleological ideas, and explicitly states that they have ruled so long because they are easy and restful ways of solving life's riddles. He holds that the polymorphism of a plant, like that of sulphur, is due to external agents, and that we should not ask for the purpose of the changes in one case more than in the other. The view just outlined is supported by facts from various sources; MacDougal has shown that etiolation is not, properly speaking, an adaptation to the dark; that plants are not to be looked upon as making efforts to reach the light. Etiolation is a response to certain factors, and may or may not be useful. Willis in his studies on the Podostemaceæ finds floral dorsiventrality, *i. e.,* zygomorphy, keeping pace in its development with increasing dorsiventrality in the vegetative organs. Zygomorphy here—so far from being an adaptation to insects—characterizes flowers that are in no sense entomophilous; the only entomophilous flowers of the group are the more primitive actinomorphic forms. If natural selection does not operate here, Willis asks, why may not other cases of zygomorphy be explained apart from insect visitation? Küster's 'Pathological Plant Anatomy' also helps to strengthen the chemico-physical view point of plant structures, in that he treats as alike the result of external agents, harmful struc-

tures, such as galls, and supposedly beneficial structures, such as aerenchyma of water plants, undifferentiated mesophyll of shade plants, etc. That all biologists are not going the way of Klebs and Morgan is evidenced by Francis Darwin's review of Klebs's book; Darwin holds that in the development of structures, adaptiveness must be taken into account, and that there is a difference between the organic and the inorganic. Verworn's biogen hypothesis and Driesch's neo-vitalism are expressions of a supposed difference between the living and non-living.

Nordhausen's experiments seem to support the Lamarckian theory, since he finds that the structural characters of shade leaves of the beech remain in large part in changed conditions. Thus useful characters, originally acquired through the agency of external factors, may be transmitted, at least in part, to later generations. On the other hand, the Lamarckian idea seems not to be supported by the work of Wiedersheim and Ball, who failed to confirm Hegler in the matter of securing an increased development of mechanical tissue in growing plants subjected to tension. Potonié has attempted to attack the problem from another side by a study of fossil plants; he claims that carboniferous plants were less perfectly adapted than those of to-day. This, however, is denied by Westermaier, who thinks that organisms must always have been as well adapted as they are now. Whatever the final outcome concerning this fundamental problem, whether the study of adaptation is scientific or unscientific, it is of value to recognize the presence of the problem; many have taken for granted on one side or the other what ought to be a subject for profound investigation.

Ganong in his splendid paper concerning the Bay of Fundy marshes has expressed another respect in which past study has been at fault, viz., in devoting paramount attention to structural rather than physiological characteristics of plants. We need to know not only about root hairs, leaf shapes and development of so-called protective structures; it is far more important to know a plant's physiological adaptation; its transpiration, its water-absorbing power, its physiological plasticity. From the hasty presentation here given it might be inferred that Lamarckians and Darwinians are necessarily regarded as believers in adaptiveness as a factor in evolution, and mutationists are necessarily supposed to hold the opposite view. This is, of course, incorrect, but it is certainly true that those who hold to mutation have laid the least stress upon the significance of adaptation. To the speaker it seems as if all three theories of evolution, and perhaps others yet unborn, are quite tenable, and that the problem of adaptation is not necessarily to be associated with any particular theory of evolution.

Not all will admit that experimental morphology is a part of ecology, but that its results are of the utmost importance in ecological interpretation can not be denied. The works of Klebs and Küster, to which allusion has been previously made, take a foremost place in this field, but in a summary of this character it will be impossible to specify details. Among the more interesting of recent experiments we may cite some which deal with the phenomena of symbiosis. Bernard's theory that tubers are essentially galls due to fungal attacks has been disputed by Laurent, who shows that concentrated solutions also induce tuberization. Bernard repeats and confirms the work of Laurent, and as a consequence broadens his view as follows: tuberization is induced by factors which cause a greater osmotic pressure within the cell. In nature fungi which penetrate the growing tissues form the chief means of

increasing the osmotic pressure. Bernard has also shown that beyond an early stage the germination of seeds of the orchids *Cattleya* and *Lælia* is quite dependent upon the penetration of an endophytic fungus into the minute embryo. Aseptic cultures into which the fungus is introduced at once show vigorous growth. Thus, as Bernard states, the orchid seedling is dependent upon a fungus for its development, much as an egg is dependent upon fertilization. In this connection it may be noted that Pinoy succeeds in getting Myxomycete cultures only in the presence of bacteria, while Molliard finds that the development of perithecia in *Ascobolus* is highly favored by the presence of other fungi in the culture. The mycorhiza literature has received several additions during the year, but no marked advance has been made in our knowledge. Möller thinks that root fungi have little or no significance in the nutrition of green plants. Tubeuf, on the other hand, holds to the common view. Neger shows that the reason why autotrophic plants flourish better in sterilized soils is because of a change in the soil rather than in the absence of fungi, as Stahl supposed.

Among the important papers of the year we must, of course, include MacDougal's study of the influence of light upon the life of plants; his general conclusion that light does not directly influence growth is of great import in ecology, as is the view that light favors the differentiation of tissues. Eberhardt has now given us a detailed account of his studies concerning the influence of dry and moist air upon plant tissues, but there are few general results which he failed to outline in his preliminary notice. We may note Winkler's study of the causes of leaf position, in which Schwendener's pressure theory is opposed, though most of Winkler's papers, as well as the polemics which they occasioned, antedate the year now closing. The regeneration studies of Winkler, Goebel and several others have an ecological bearing but time will not permit their consideration. Bonnier has made some interesting morphological experiments on orchid roots, as has Benecke on the thalli and rhizoids of liverworts. Benecke finds that impurities in the glassware commonly employed in laboratories are responsible for some results, and in this connection we should note the work of Singer and Richter upon the influence of laboratory air in experimental cultures. These and other considerations demand that as much work as possible should be done out of doors, or at least in well-controlled greenhouses. From an ecological point of view much experimental work that is done in the laboratory or even in the greenhouse is of no direct value. Ganong, in his marsh paper, makes an appeal for field laboratories in connection with future ecological work, and it must be admitted that his argument is sound. The tropical laboratories and the recently installed desert laboratory are steps in the right direction, but even in these cases the experimental work which is to be of the greatest ecological value, must be performed not in the laboratories, but out of doors. In this, which the speaker believes to be the most promising line of ecological research, Bonnier has led the way in his magnificent experiments upon alpine plants. During the past year he has reported upon his parallel cultures at Paris and Toulon, in which portions of the same individual plant and identical soils are employed. He finds that his Toulon cultures from Paris plants are showing characters which the same species show in nature about Toulon, a result in harmony with his earlier alpine studies.

Among contributions based more on observation than experiment are: Paul on the biology of moss rhizoids, in which he maintains that they are primarily of value

as holdfasts; Kraemer on the epidermis, hypodermis and endodermis of angiosperm roots; Grimme on the flowering period of German mosses—a detailed and instructive paper; W. E. Britton on the anatomical features of the plants of the Connecticut sand plains; Bray's anatomical studies of desert plants; Parkin and Pearson on the anatomical characters of the plants of the Ceylon Patanas. These latter authors are surprised to find that the structures are as xerophytic in the wet as in the dry prairies, although it is nearly fifteen years since Schimper showed that xerophytes may be typical of certain wet habitats.

In ecological phytogeography the closing year has witnessed a considerable display of literature in America and England. Possibly no preceding year has afforded so many contributions. In our own country, one must give a prominent place to Ganong's paper on the Bay of Fundy marshes, a paper giving the results of the author's studies during several years in one of the most interesting physiographic areas in the world. As many of us know, Professor Ganong has postponed from year to year the publication of this paper, fearing lest errors might creep in that the study of just another season would rectify. Would that many another might heed his caution, and spare the world the undigested results of a week's ecological excursion! The completeness of detail and the accuracy of statement in Ganong's paper may well serve as models to working ecologists. Probably the harshest criticisms which his paper will receive are contained in his own concluding remarks. One of his suggestions, in addition to those already noted, may be mentioned here, viz., the necessity of finding a means of estimating quantitatively the biological factor, *i. e.*, the exact influence of competition and cooperation in determining the vegetation of a plant association. Another worker, and the only one who has so well exploited his particular field in America, is Bruce Fink, so long and so favorably known for his lichen studies; his recent development of lichen associations has added materially to our knowledge. The speaker has long felt that lichens are among the most interesting of plants ecologically, because they are so closely related to the unmodified physical environment. If any plants will show whether purely chemical factors are of influence in distribution, we should expect rock lichens to be of service in this regard. Apropos of this question of physics versus chemistry, one must mention the recent bulletin of Whitney and Cameron, in which the physical factor is given the dominant place. This view has been accepted readily by most ecologists, ever since Warming, following Thurmann and others, so clearly outlined the overwhelming importance as an ecological factor of the physics of the soil in relation to water. Other important American papers are: Livingston on the vegetation of Kent County, Michigan, presenting a model detailed map which represents a type of illustration too infrequent in American ecology; Transeau on the distribution of the bog societies of North America; Harshberger on the vegetation of mountainous North Carolina. In Britain the work of the lamented Robert Smith has been continued by his brother, who in cooperation with others has given two papers dealing with the vegetation of Yorkshire.

Several papers of more than ordinary interest from the view point of physiographic ecology, apart from Ganong's paper on the Bay of Fundy marshes, are as follows: Cajander's study of the alluvial vegetation of the Lena River, containing excellent analyses of phytogeographic terms as well as discussions on the genetic succession of associations; Penzig's study of the development of vegetation on Krakatoa since Treub's visit some years since; Häyren's

paper on the development of vegetation on the coast of Finland; Düggeli's detailed study of a Swiss valley about to be occupied by a reservoir, giving a basis for a study of the changes which will ensue; Weber's exhaustive study of the development of German moors; Huber's account of the encroachment of vegetation upon new islands in the Amazon. It is a pleasure to see such a list as this, probably the largest and best furnished by any single year to the study of association dynamics or physiographic ecology. While, as indicated above, the interpretation of ecological facts must be regarded as the ultimate end of ecological endeavor, the proximate end must largely be the collection of such facts. We deceive ourselves if we believe that this task has been more than fairly begun. Among the most important facts to be collated are those bearing upon the natural changes which the vegetation of a region undergoes. One may enter a field and make a guess as to what these changes are—this guess may or may not be intelligent; one can find each variety in literature—but the sole way to know what changes occur is to make detailed studies of limited areas year by year. In connection with ecological phytogeography one should mention also the admirable Vegetationsbilder issued by Karsten and Schenck, which serve to give photographic illustrations of distant and especially tropical landscapes. The studies of Engler in German East Africa and Cockayne in New Zealand should be included among the noteworthy contributions to knowledge. And it is, perhaps, in place to recall here the long-promised English translation of Schimper's 'Plant Geography,' which has so recently appeared.

Floristic phytogeography probably should not be classed under ecology, but there are many inter-relations between ecological and floristic aspects, which make a short survey of the field necessary. One of the remarkable contributions of the year is a volume by Hugo Bretzl on the botanical results of Alexander the Great's journey to the east, as reported by Theophrastus. As the speaker pointed out a year ago, too little attention has been paid to the phytogeographic contributions of Linnæus and other former workers. Bretzl's work shows that the Greeks observed and recorded a number of things for which but scanty credit has heretofore been given. The mangrove forests are described with great detail and accuracy; even the relation of various species to saltness is dwelt upon, and correctly. The Greeks were surprised to find conifers on the Himalayas and concluded that the vegetation of tropical mountains resembles that of European lowlands. Theophrastus gives the physiognomy of vegetation in terms of leaf forms; for doing this same thing only a century ago, most writers have given Humboldt the credit of founding phytogeography. Theophrastus anticipated many modern views in morphology and physiology, which of course have no place in this review. Beguinot has shown also that Porta, in his 'Phytognomonica,' published some centuries since, had a knowledge of many principles of distribution. One of the great floristic contributions of recent date is Jerosch's history and origin of the Swiss alpine flora, a volume which makes no pretensions of being more than a compilation, but which places in compact and trustworthy form the results of many workers. Other important floristic works are those of Alboff on Fuegia, R. L. Praeger on Ireland and Parrish on southern California. Among paleontological works bearing on distribution, perhaps the foremost place should be given to Flahault's volume on paleobotany in relation to present vegetation, a work of over two hundred pages and by a master hand. One must at least call by name Seward's presidential address before the

botanical section of the British Association on the geographic distribution of past floras, Wieland's novel but not new view as to the polar origin of life, and Schulz's papers on the geological development of the flora of the Saale and the Suabian Alps.

In closing, a word may be said as to the present status of Briquet's polytopic theory, a theory commonly discarded as untenable, but which the mutation theory and the growing belief in polyphylesis make more probable. The idea that a species may originate in more than one place, simultaneously or not, did not originate with Briquet, but he resuscitated it and christened it the polytopic theory. Though discarded by Jerosch and most writers, as unlikely if not unthinkable, Willis believes that the same step might be taken by species that are far apart, especially in similar conditions; indeed he thinks that this has actually happened within the Podostemaceæ. Arber has favored the idea of homeomorphy or parallelism of descent. Engler has admitted that varieties may originate more than once. It will be recalled that in DeVries's experiments the same species recurred many times, and that too from different parents. Blackman has found that about twenty per cent. of the arctic and antarctic algæ are identical as to species, but not found elsewhere. It will be conceded that in such a case the difficulties in the way of migration during the present or past ages are very great, while the polytopic theory seems to afford an easy explanation. Perhaps it is too easy; in any event it seems adapted for use as a last resort rather than as a general panacea. However, the researches of the past few years have placed the theory of polytopic origins in a position to demand the thoughtful consideration of all students of evolution.

HENRY CHANDLER COWLES.

SCIENTIFIC BOOKS.

Desert Botanical Laboratory of the Carnegie Institution. By FREDERICK V. COVILLE and DANIEL TREMBLY MACDOUGAL. Published by the Carnegie Institution. Washington, November, 1903. Pp. 58, with 29 plates and 4 charts.

This attractive account of a botanical reconnoissance of the desert areas of the southwest will, without doubt, awaken great interest in desert vegetation, and stimulate the thorough investigation of the adaptations of xerophytes. The debt which ecology owes to Drs. Coville and MacDougal for fostering the idea of a desert laboratory, and for carrying it to a successful conclusion must become more and more apparent as the work progresses. The report deals in a very interesting though necessarily general fashion with the vegetation of the areas visited in connection with the location of the laboratory. These were: (1) The arid region of western Texas; (2) the sand dunes of Chihuahua; (3) the White Sands of the Tularosa Desert; (4) the vicinity of Tucson; (5) the gulf region about Torres and Guaymas; (6) the Colorado Desert; (7) the Mohave Desert; (8) the Grand Canyon of the Colorado.

In many ways the most interesting region to the ecologist is that of the White Sands of the Tularosa Desert. These are for the most part mobile dunes, composed entirely of gypsum; they cover nearly four hundred square miles. The soil is necessarily alkaline, a fact clearly indicated also by the abundance of *Atriplex* and *Suæda*. The characteristic vegetation of the dunes consists of woody plants, chief of which are *Rhus trilobata, Atriplex canescens, Chrysothamnus* and *Yucca radiosa. Yucca,* by virtue of its striking ability to push up through a sand cover, is a typical dune former. The White Sands when critically investigated should add an interesting chapter to the developmental history of dunes. The selection of Tucson for a laboratory site was based upon the variety and distinctness of its desert flora, as well as upon its being both habitable and accessible. The vegetation in the neighborhood of Tucson consists mostly

of *Covillea, Prosopis, Acacia, Opuntia, Echinocactus, Cereus, Parkinsonia,* etc. The presence of the Santa Catalina range, which rises to 6,000 feet, adds a mountain element to the vegetation. A further advantage of great importance lies in the central location of the laboratory with reference to the deserts of Texas, Mexico and California.

The general physical features of deserts are discussed in a caption filled with valuable meteorological and soil data. In connection with the latter, it is pointed out that lack of water is the fundamental cause of deserts, and that areas in which the water content is largely non-available are deserts as well as those in which the water content is low. The current conceptions of deserts are shown to be wholly inaccurate, particularly with respect to vegetation. Two great desert regions, called the Sonora-Nevada and the Chihuahua desert, are recognized by the authors. The former corresponds to the Great Basin region and the dry coast lands of northwestern Mexico; the latter extends northward from Chihuahua through parts of Arizona, New Mexico and Texas to the Bad Lands of South Dakota and the Red Desert of Wyoming. The annual rainfall in the most intense areas is less than 3 inches; in the least intense, 14–16 inches. Maximum temperatures of 110°–120° F. are frequent during the summer. The relative humidity is very low, the minimum frequently falling below 15°. The critical investigation of the physical factors, especially the water content, of these deserts is an alluring field for future workers at the Desert Laboratory.

Dr. MacDougal contributes a series of instructive experiments upon the transpiration of certain xerophytes of the region with relation to temperature, and makes an illuminating comparison of the results with those obtained from mesophytes. The xerophyte, in spite of its great insolation and the low humidity, loses water less rapidly than the mesophyte. The report closes with a valuable bibliography of desert vegetation, and of the climate, soil and water of deserts, which has been prepared by Dr. Cannon. It can not be too highly praised for the beauty of the plates, which have a much greater value for the understanding of the text than is at present the fashion in ecology.

Frederic E. Clements.

University of Nebraska.

International Catalogue of Scientific Literature. First Annual Issue—Q—Physiology. Including Experimental Psychology, Pharmacology and Experimental Pathology. Part I., pp. xiv + 404, 1902. Part II., pp. xii + 664, 1903. London, Harrison & Sons.

Physiologists will heartily welcome this long-expected catalogue. The first volume, which has recently appeared after some delay, is devoted to the literature of 1901 (a fact which should be, but is not, mentioned on the title page), and includes 1,094 pages of text and the surprisingly large number of 6,010 titles. Owing to the difficulties of organizing the work of the regional bureaus in the time at hand, it is issued in two separate parts; but it is intended that in the future only a single unbroken volume in each year shall be published. Each part of the present volume opens with a preface and instructions to the reader, both in the English language only. It would enhance their value if the instructions were printed also in French, German and Italian. There follow in order a schedule of classification and an index of the subject-matter of the science, which are repeated in each of the above four languages; then an authors' catalogue and a subject catalogue; and, lastly, a list of journals.

The scheme of classification of subject-matter is practically that which was submitted for criticism five years ago, though a considerable number of new subjects are introduced, and the order in some cases is changed for the better. It is to be regretted that one defect, earlier pointed out, was not remedied, namely, the introduction of a group to include general physiological phenomena, such as physiological division of labor, irritability, summation of stimuli, rhythm, specific energy, automaticity, fatigue, etc. If a reader wishes to learn what has been written on these subjects during the year, he finds it possible only by going through practically the whole scheme of classification. Rhythm and fatigue are found entered in the

index, it is true, but in a misleading way, for when one turns from them in the index to the corresponding numbers in the scheme of classification one finds 'rhythm' entered under 'hearing' and 'fatigue' under 'sense of movement.' Certain other subjects within the sphere of modern general physiology are not sufficiently elaborated. For example, all the tactic irritabilities, the literature of which is already large and constantly increasing, are grouped under one entry—'0150 Influence of Environment (Chemotaxis, Galvanotaxis, etc., High Altitudes, etc.)'—and are not mentioned specifically in the index. 'Secretion' as a general physiological phenomenon occurs nowhere, and there is no entry for 'internal secretion.' Some of the defects here mentioned are due to the fact that the basis of the scheme of classification is essentially morphological. The physiological literature of a particular organ can readily be found: not so readily the literature of a particular physiological principle. Though excellent in its details, the scheme of classification is too short-sighted. It is not yet too late to remedy this great defect. Let the numbering of the general groups, 'Physiology of the Organism as a Whole, 01,' and 'Physiology of the Cell and of Unicellular Organisms, 02,' be changed to '02' and '03' respectively; then let there be inserted a new group numbered '01' and entitled 'General Physiological Phenomena.' This group, properly elaborated, would contain at least many of the general subjects referred to and would facilitate the introduction of very valuable cross references. In future volumes this change, or an equally appropriate one, ought to be made, if the catalogue is to fulfill its high purpose.

The actual work of cataloguing seems to be well done. The cross references are numerous, both within the present volume and to volumes of the catalogue devoted to other sciences. There is a surprisingly small number of typographical errors. The typography is clear and of sufficient variety to facilitate the search for data. There is a natural curiosity on the part of the reader to know how near the list of titles approximates to completeness. A search within its pages for the articles published during 1901 in five representative journals of different countries, shows the following percentages of omissions: *Journal de Physiologie et de Pathologie générale*, 1 per cent.; [English] *Journal of Physiology*, 2 per cent.; *Archives Italiennes de Biologie*, 3 per cent.; *Pflüger's Archiv für die gesammte Physiologie*, 24 per cent.; *American Journal of Physiology*, 48 per cent. Our own country thus compares most unfavorably with those of Europe. Not only, however, are the contents of the American journals incompletely catalogued, but the list of our journals is incomplete, comprising in the present volume only nineteen in number, and omitting such well-known periodicals as the *Journal of Comparative Neurology and Psychology*, the *Journal of Medical Research* and the *Psychological Review*. Since each regional bureau is responsible for the literature of its own country, a critic is at first tempted to lay these faults at the door of the Smithsonian Institution. Their real cause, however, must be sought further back. Although duly and repeatedly petitioned for assistance, our government, unlike those of many of the European countries, has given no support to the work of our regional bureau; the expense has been assumed gratuitously by the Smithsonian Institution, which, however, has been greatly embarrassed by lack of funds. It is gratifying to know that this institution has recently been enabled to make more extended provision for the work. This will allow the deficiencies of the present volume to be made up subsequently, and will insure greater thoroughness in the future. Professor Langley invites any suggestions which will lead to the improvement of the catalogue. It is to be hoped especially that American physiologists will call his attention to such additional journals as publish either frequently, or even rarely, articles on physiological topics. In doing this it should be borne in mind that the physiology of the catalogue includes physiological chemistry, pharmacology, experimental psychology and experimental pathology. The literature of bacteriology is catalogued in a separate volume.

Americans can helpfully cooperate in still another manner, namely, by subscribing for

the catalogue. The cost of the annual volume on physiology is $9.20. Many physiologists will probably wish also the volume on general biology, the annual price of which is $2.45. The Smithsonian Institution acts as the representative of the central bureau in the United States, and receives subscriptions.

The International Catalogue is the one catalogue of scientific literature whose permanence can be relied upon. Its first issue is full of promise. Its ultimate completeness will be hastened by the cordial cooperation of those whose labors it is intended to lighten.

FREDERIC S. LEE.

COLUMBIA UNIVERSITY.

SOCIETIES AND ACADEMIES.

THE WASHINGTON MEETING OF THE AMERICAN PHYSICAL SOCIETY.

THE spring meeting of the American Physical Society was held at Washington, D. C., April 22 and 23, at the invitation of the Washington Philosophical Society. Two sessions for the reading of papers and an evening lecture by Dr. Alexander Graham Bell on his famous tetrahedron kites were all held at the rooms of the Cosmos Club. These and other courtesies of the Cosmos Club were much appreciated by the society.

On Friday evening a considerable number of members of the society dined together at the Hotel Barton, and on Saturday, at the close of the morning session, the Philosophical Society entertained all members of the Physical Society who had been attending the session at luncheon at the same hotel. In the afternoon a visit was made to the new buildings of the Bureau of Standards, which are located near Connecticut Avenue in the northwestern suburbs of the city, about four miles from the White House.

There was a good attendance at the meeting and an unusually full list of papers was presented. All the papers in the following list were presented by the author or authors, excepting those by S. J. Barnett and A. A. Bacon, the authors being absent, and E. B. Rosa and M. G. Lloyd, because the hour for luncheon had arrived.

K. E. GUTHE: 'A Study of the Silver Voltameter.'

P. G. NUTTING: 'Some new Rectifying Effects in Conducting Gases.'

E. L. NICHOLS and ERNEST MERRITT: 'The Effect of Light on the Absorption and Electrical Conductivity of Fluorescent Liquids.'

F. A. SAUNDERS: 'Some Additions to the Arc Spectra of the Alkali Metals.'

W. F. MAGIE: 'The Volumes of Solutions.'

G. W. PATTERSON: 'Absolute Electrodynamometers.'

E. P. ADAMS: 'Induced Radioactivity due to Radium.'

S. J. BARNETT: 'The Energy Density, the Tension, and the Pressure in a Magnetic Field.' (Read by title.)

L. A. FISCHER: 'A Recomparison of the U. S. Prototype Meter at the International Bureau of Weights and Measures.'

C. W. WAIDNER and G. K. BURGESS: (*a*) 'High Temperature Measurement by means of Optical Pyrometers.' (*b*) 'Note on Special Problems in Optical Pyrometry.'

C. W. WAIDNER and H. C. DICKINSON: 'Apparatus for Platinum Resistance Thermometry.'

C. W. WAIDNER and H. C. DICKINSON: 'Intercomparison of Primary Standard Mercurial Thermometers.'

F. A. WOLFF: 'The Standard Cell.'

F. A. WOLFF: 'The Peculiar Behavior of Some Resistance Standards and Its Explanation.'

F. A. WOLFF: 'A Direct Reading Apparatus for the Calibration of Resistance Boxes.'

E. B. ROSA and F. W. GROVER: 'Absolute Measurement of Capacity.'

E. B. ROSA and F. W. GROVER: 'Absolute Measurement of Inductance.'

E. B. ROSA and F. W. GROVER: 'The Testing of Mica Condensers.'

E. B. ROSA and M. G. LLOYD: 'Testing of Alternating-Current Instruments.' (Read by title.)

A. A. BACON: 'Equilibrium of Vapor Pressure over Curved Surfaces.' (Read by title.)

E. B. ROSA,
Secretary pro tempore.

THE BOTANICAL SOCIETY OF AMERICA.

THE annual report of the secretary embodied in Publication 24 is a statement of conditions and record of progress during the first decade of the existence of the society that must be highly satisfactory to its mem-

bers. The total constituency of the society now numbers 58, and its accrued funds amount to nearly three thousand dollars, a large part of which is treated as permanent endowment, the income only being used. Recently the policy has been adopted of making grants from current funds in aid of investigations by members and associates. Thus far the following awards have been made:

To Dr. Arthur Hollick, for the study of the fossil flora of the Atlantic coastal plain, $200.

To Dr. D. S. Johnson, for the study of the seeds and endosperm of the Piperaceæ and Chloranthaceæ, $200.

To Dr. J. C. Arthur for investigations on plant rusts, $90.

To Dr. C. J. Chamberlain, for the study of the spermatogenesis, oogenesis and fertilization of *Dioon* and *Ceratozamia*, $150.

To Professor F. E. Lloyd, for the study of certain types of desert vegetation to be carried on at the Desert Botanical Laboratory of the Carnegie Institution, $150.

To Dr. J. C. Arthur, for securing drawings of rusts, $50.

In order to promote unity of botanical interests a committee consisting of B. T. Galloway (chairman), C. R. Barnes and C. E. Bessey was appointed at the St. Louis meeting and requested to prepare a plan for cooperation with other botanical organizations, for consideration at the eleventh annual meeting.

The increasing demand upon the time allowed by the society for the presentation of scientific papers has made necessary the action of the council in accepting only papers from members, associates and persons specially invited to contribute by the council. The programs, almost without exception, are now made up from papers, the titles of which are sent to the secretary in advance of the meetings.

Among those who have recently presented papers before the society by special invitation are Professor K. Goebel, of Munich, Germany; Professor H. de Vries of Amsterdam, Holland; Professor T. H. Morgan, of Bryn Mawr, and Mr. Frances Darwin, of Cambridge, England.

The reprinted addresses of the past presidents are the only scientific publications issued by the society and may be taken as a fair index of the maturer investigations that have been prosecuted in America. The list includes the following titles:

PROFESSOR WILLIAM TRELEASE: 'Botanical Opportunity.'

PROFESSOR CHARLES E. BESSEY: 'The Phylogeny and Taxonomy of Angiosperms.'

PROFESSOR JOHN M. COULTER: 'Origin of Gymnosperms and the Seed Habit.'

PROFESSOR L. M. UNDERWOOD: 'The Last Quarter; The Reminiscence and an Outlook.'

PROFESSOR B. L. ROBINSON: 'The Problems and Possibilities of Systematic Botany.'

PROFESSOR J. C. ARTHUR: 'Problems in the Study of Plant-rusts.'

DR. B. T. GALLOWAY: 'What the Twentieth Century Demands of Botany.'

At the tenth annual meeting recently held in St. Louis the following associates were elected members:

Frederick Edward Clements, University of Nebraska.

Henry Chandler Cowles, University of Chicago.

William Ashbrook Kellerman, The Ohio State University.

Also the following associates were elected:

William Austin Cannon, Desert Botanical Laboratory, Tucson, Arizona.

Karl McKay Wiegand, Cornell University.

The officers for 1904 are:

President—Frederick Vernon Coville, U. S. Dept. of Agriculture, Washington, D. C.

Vice-President—Charles Edwin Bessey, The University of Nebraska, Lincoln, Nebraska.

Treasurer—Arthur Hollick, New York Botanical Garden, New York City.

Secretary—Daniel Trembly MacDougal, New York Botanical Garden, New York City.

Councilors—Benjamin Lincoln Robinson, Gray Herbarium, Harvard University, Cambridge, Mass., and John Merle Coulter, University of Chicago, Chicago, Ill.

The above officers, with Past President Charles Reid Barnes, constitute the council of the society.

D. T. MACDOUGAL,
Secretary.

THE NEW YORK ACADEMY OF SCIENCES.
SECTION OF ANTHROPOLOGY AND PSYCHOLOGY.

The regular meeting of the section was held on March 28 in conjunction with the New York Branch of the American Psychological Association. The afternoon session was held at the Psychological Laboratory of Columbia University, the evening session was held as usual at the American Museum of Natural History. The program was as follows:

Mental Resemblance of Twins: Professor E. L. Thorndike.

A report was made on the general results of a comparison of twins in tests of attention, perception, association, rate of movement, addition, multiplication and stature. The resemblances as measured, by a rough, preliminary method, were about .75. The amount of this resemblance that should be attributed to similarities in home training was apparently slight. There was no evidence in the results to support the theory that twins fall sharply into two species, those very closely alike and those no more alike than ordinary brothers and sisters.

Measurements of the Mentally Deficient: Miss Naomi Norsworthy.

The paper was a report of some work done among one hundred and fifty mentally deficient children in two state institutions for the feeble-minded and in two of the special classes organized in the New York schools. The measurements taken were physical, such as height, height and temperature, tests of maturity, as perception of weight and of form, tests of memory and tests of intelligence or the ability to deal with abstract ideas. The main conclusion reached was that the difference between idiots and people in general is less than has been commonly supposed, and is a matter of degree rather than of kind.

Color Contrasts: Dr. R. S. Woodworth.

Dr. Woodworth presented a modification of Hering's binocular demonstration of the 'physiological' origin of simultaneous contrast. If monocular fields of different colors, with a gray spot on each, be combined by the stereoscope, each gray retains the contrast color suitable to its own field, however the conscious background may vary as the result of fusion or rivalry of the two fields. The demonstration is readily extended to cover brightness contrast, by placing gray spots on white and black fields which are combined as before. To show that these effects are not the result of a binocular mixture of the gray with the opposite field, a number of gray spots may be scattered over one field, and the other field made particolored; the gray spots appear all alike, or nearly so, though binocular mixture would have made them differ.

New Apparatus and Methods: Professor J. McKeen Cattell.

(1) Kymographs were exhibited in which typewriting ribbons were applied to secure the records. Electro-magnetically moved points strike the paper tape, whose rate of movement may be adjusted, and a record is left by the slowly moving typewriter ribbon. Two forms were exhibited, in one of which the kymograph was driven by an electric motor and in the other by clock-work. In the latter the clockwork could be started and stopped by an electric current by an observer in another room. The kymographs, while not especially suited for drawing curves, are much more convenient than smoked paper or siphon pens for time records, such as rhythms, conflict of the visual fields, after-images, etc. (2) Instruments were shown by which a number of faint clicks could be given at intervals of a second for testing sharpness of hearing and defective hearing. Instead of giving the observer a continuous sound, such as from the ticking of a watch, two, three, four or five faint sounds are made, and the observer is asked how many he hears. By this method errors from the common illusion in the case of faint sounds are avoided. (3) A method was exhibited for testing color blindness by the time it takes to distinguish one color from another. By the normal individual red can be distinguished from green in about the same time as blue from yellow, but it takes longer to distinguish red from orange. If the observer belongs to the red-green class of the color blind, he can distinguish blue from yellow as quickly as others, but not red from green. An instrument was shown by which

the conditions of the railway service can be imitated, it here being necessary first to distinguish a certain color and then to make the proper movement.

The Time of Perception as a Measure of Differences in Sensation: V. A. C. HENMON.

The aim of the investigation upon which this paper is based is to measure qualitative differences in color by the time of perception. The colors taken as standards were red, orange and yellow, whose wave-lengths had been definitely determined. Equal intermediate steps between orange and red were produced by the mixture of pigments. Small squares of each of these colors, 3 x 3 cm., were mounted on cards side by side with red, and exposed to the subject by means of a drop-screen so arranged as to give almost instantaneous exposure. The subject reacts with the right or left hand according as the predetermined stimulus appears to the right or left. The registration is made with the Hipp chronoscope. The results of 6,000 reactions gave evidence of the validity of the method and the fruitfulness of the problem. Equal objective differences are correlated with differences for consciousness, showing a definite increase as the magnitude of difference is decreased.

The Daily Curve for Efficiency: Mr. H. D. MARSH.

Habits Based on Analogy: Professor CHARLES H. JUDD.

The Determination of the Habit Curve for Associations: Professor J. E. LOUGH.

A report of experiments made in the psychological laboratory of the school of pedagogy. It was found that the time required to write series of letter-equivalents when the 'key' of equivalents was not memorized, but was consulted as frequently as necessary, diminished as the associations between the letter-equivalents became more habitual. The curves representing the results of these experiments exhibit all the characteristics of the typical habit curve. Repetition of the experiment using new 'keys' shows little or no interference due to earlier associations, while with each succeeding 'key' the physiological limit was reached after a constantly diminishing number of trials.

A Neglected Point in Hume's Philosophy: Dr. WILLIAM P. MONTAGUE.

The paper aimed to show (1) that Hume (in Part IV., Section II. of the 'Treatise') had quite unwittingly furnished what from his own point of view should have been regarded as a logical deduction and justification —rather than the mere psychogenetic description, which it purported to be,—of the realistic belief in the independent and uninterrupted existence of sensible objects; and (2) that the *naïve realism* or positivism thus accidentally promulgated was from both the scientific and the popular standpoint, a far sounder and more inviting doctrine than the empirical idealism or sensationalism with which Hume's name is usually associated.

Action as the Concept of Historical Synthesis: Mr. PERCY HUGHES.

Rickert's description of the content of history as reality is amended to read *past reality,* the past of evidence. From this definition the individual, objective, moving and continuous character of historic content follows; and further, the conception of action as descriptive of both historic content and historic synthesis. An historical synthesis is a past action that itself has created a certain synthesis of evidence; which the historian discovers. In such synthetic actions, 'simple' actions retain their individuality as means, stimuli or hindrances to the main action, *i. e.,* in a functional relation.

At the close of the afternoon session the members were invited to attend a lecture given in Columbia University by Professor John Dewey on 'The Psychologist's Account of Knowledge.'

JAMES E. LOUGH,
Secretary.

SECTION OF GEOLOGY AND MINERALOGY.

THE section held its regular meeting Monday evening, May 16, with the chairman, Professor James F. Kemp, presiding.

The following program was offered:

*Exhibition of the Series of **Foot Bones Illustrating the Evolution of the Camel, Recently Installed in the Hall of Vertebrate Paleontology of the American Museum of Natural History:*** W. D. Mathew.

This series corresponds to that illustrating the evolution of the horse, and is almost equally complete.

It shows the derivation of the camel from small primitive four-toed ancestors which are exclusively North American in habitat. The earliest known ancestors are tiny animals no larger than a rabbit. The camels reached their maximum size and abundance in the Pliocene epoch, when they were much larger than the modern camels. Then they spread to the other continents, disappeared entirely from North America, and became smaller in size and far less numerous in species elsewhere.

Some Erosion Phenomena in St. Vincent and Martinique: Edmund Otis Hovey.

In this paper the author showed lantern slides from some of the photographs taken by him in those islands in 1902 and 1903, for the American Museum of Natural History, which illustrated the development of new drainage systems and the reinstatement of old channels in regions which were most thickly covered with ejecta by the 1902 and 1903 eruptions of the Soufrière and Mont Pelé.

The principal paper of the evening was:

Some of the Localities in France and England where Monuments of the Late Stone and Bronze Ages have been Found: J. Howard Wilson.

In considering the subject of these stone monuments, the author confined himself to those found in northern France and southern England, and especially the great groups near Carnac in Morbihau, and the well-known temples of Stonehenge and Avebury, in Wiltshire.

The monuments were divided according to type into several classes, and a description of each of these given briefly with their comparative ages and the probable purposes for which they were constructed. Legends concerning these monuments were cited, and mention was made of the superstition and veneration with which they have been regarded by some of the more ignorant and conservative peasants, causing the worship of stone to be kept up to the present day in some remote districts.

Before closing the paper, attention was called to the engineering skill required in the placing and erection of some of the monuments and the early age at which it made its appearance.

The paper was followed by slides showing photographic views of some of the most famous monuments, maps and drawings of several of the curiously engraved stones.

Edmund Otis Hovey,
Secretary.

DISCUSSION AND CORRESPONDENCE.

THE COMPLEX NATURE OF THORIUM.

To the Editor of Science: The following appeared in *Nature*, April 28, p. 606:

THE COMPLEX NATURE OF THORIUM.

With regard to several letters on thorium and its complex nature that appeared in *Nature* of March 24 and 31, April 7 and 14, and in which my name is mentioned, I take the liberty of adding a few remarks, having had ten years' experience in working with thorium.

In 1897, at a meeting of the British Association in Toronto (Canada), I read a paper in which I pointed out that spectrum evidence proves the complex nature of thorium.

In 1898 (*Chem. Soc. Trans.*, p. 953) I isolated from some thorium fractions an earth with an atomic weight of 225.8 (tetrad). Knowing the difficulties of the separation of rare earths (I have been engaged in this kind of work since 1878), and not wishing to publish a premature conclusion, I did not declare this to be a novel constituent of thorium, but said that foreign earths were present, in spite of the fact that the reaction used ought to have separated them.

In 1901 I published another short paper (*Proc. Chem. Soc.*, March 21, 1901, pp. 67–68), in which I said that "my experiments may be regarded as proving the complex nature of thorium. Thorium was split up into the Th^{α} and Th^{β}. With Th^{β} I obtained so low an atomic weight as $R^{iv} = 220$. The fractions Th^{α} gave by the analysis of the oxalate, though it was prepared by pouring the thorium salt solution into an excess of oxalic acid, in order to avoid the formation of

a basic salt, the high atomic weight $R^{iv} = 236.3$. But I stated expressly, and I feel obliged to repeat it, that these fractions show a great tendency to form basic salts. Assuming these to be normal, a higher atomic weight than the true one is obtained. This is true especially in regard to the oxalate.

The splitting up of thorium into Th^{α} and Th^{β} was, of course, not so sensational an event as the announcement from America of the splitting up of thorium into 'carolinium' and 'berzelium.'

BOHUSLAV BRAUNER.

Bohemian University, Prague,
April 18.

Those who have read my work and heard my recent paper delivered before the Washington, New York and North Carolina sections of the American Chemical Society do not require further information regarding the above. In view of the fact that many British men of science are not familiar with the work and may be misled, it has been deemed wise to despatch the following to the editor of *Nature*.

Re Thorium.—The elementary nature of thorium has been questioned by several workers, namely, Chroustschoff in 1889 (*J. russ. phys. Chem. Ges.*, 29, 206), Rutherford in 1899 (*Phil. Mag.*, 49, 2, 1900), Crookes in 1900 (*Proc. Roy. Soc.*, 66, 406) and in 1901 Brauner (*Proc. Chem. Soc.*, 17, 67) and Baskerville working independently (*Journ. Am. Chem. Soc.*, 23, 761). The methods employed were different in each case.

The undersigned has made no claim of priority as to the idea of the complexity of thorium, but he distinctly claims to have applied novel methods and an old one, which demonstrate to the satisfaction of himself and others familiar with the work, not only the complexity of old thorium, but the existence of two new elements to which the names of carolinium and berzelium have properly been given. The old method was used by Berzelius, who died thirty years before the plaintiff, according to his own statement (April 28, p. 606), began his work on the separation of the rare earths.

Scientific men will await the appearance of the paper, which will be published shortly in the *Journal of the American Chemical Society*, and see that all workers have received full credit for their share in the solution of the question. In the meantime, the letter adverted to, carrying much that is true and a distortion, which any one may verify by reference to the literature, to say the least is in poor taste.

For fear lest the old proverb, '*qui tacet consentire videtur*,' carry too much influence, the above statement is reluctantly made.

CHAS. BASKERVILLE.

UNIVERSITY OF NORTH CAROLINA, U. S. A.,
May 17, 1904.

A REDDISH-BROWN SNOWFALL.

TO THE EDITOR OF SCIENCE: An incident which should, perhaps, be recorded is that of a reddish-brown snowfall which occurred at this place on February 2 last (1904). A light snow was falling on that day and about noon the character of the snow-fall changed to a reddish-brown or light chocolate color. This continued for half or three quarters of an hour, after which the snow-fall of ordinary appearance continued during the afternoon, the colored snow appearing as a well-defined layer between the white snow which fell before and after it. An examination under the microscope showed numerous irregular-shaped, semitransparent particles with an appearance similar to feldspar. Nitric and muriatic acid applied to them gave no apparent result. Examined microscopically during the snow-fall it appeared that the particles were not carried on the snow, but were embedded in the snow crystals. Other ordinary contaminations were present, but were plainly distinguishable from the peculiar particles in the snow crystals. The phenomenon was observed in two or three near-by towns, but, so far as learned, not outside this immediate vicinity.

EDWARD LINDSEY.

WARREN, PA.,

SPECIAL ARTICLES.

MENTAL EFFICIENCY AND HEALTH.

IN the address as president of the American Society of Naturalists, read by Professor Cattell at the annual dinner, January 1, 1903, and printed in this journal, April 10, 1903, is inserted a table giving the grades for different

mental traits assigned by twelve independent judges to five American men of science.

Though these individuals are merely cited from a list of thousands in illustration of the methods employed in collecting data for the study of mental characters, the figures given in the table have an apparent bearing upon the question of the relation which exists between the quality and efficiency of a man's mental activity and his constitutional physical health. I should like to call attention to certain facts deducible from the table, and to express the hope that in preparing the results of the study for publication this aspect of the problem may not be overlooked.

Of the five persons graded one ranks very high in physical health, one is decidedly low, one falls close to the indifference line of the series, and the other two lie at points considerably above and below this mean. The range of physical variations is thus wide enough to enable one to observe clearly any mental and physical correlations which exist.

A glance at any one of the following sets of figures into which the table given on page 568 has been distributed, will show at once that certain marked features of correlation appear, but that the mental grading does not parallel throughout the variations in physical health. As regards individuals, *D* is so consistently divergent as to belong to a separate group from the other four, who present a fairly well-marked series of correlations. The grades of health in the five men, from which comparison proceeds, together with the average ranking of each in the whole series of mental traits are given in the following table:

Men.	*D*	*A*	*B*	*C*	*E*
Health,	90	63	55	26	12
Traits,	43.6	77.6	56.4	46.9	24.1

The grades, it will be recalled, are on a scale of 100. The letters indicating individuals in the original article are retained in the present tables. With the exception of *D* the estimation of general efficiency in the members of the group rises and falls with the condition of physical health. As these figures are the representatives of a set of curves which are not all consistent, I have distributed the twenty-three traits in several groups into which they seemed naturally to fall, and which may be described as follows: Mental range and balance, intellectual capacity, emotional sensibility, energy of will and social adaptiveness. The special traits included under these several heads are mentioned in connection with each set of figures.

Men.	*D*	*A*	*B*	*C*	*E*
Mental balance,	45	84	79	32	20
Judgment,	30	96	70	30	15
Breadth,	63	93	74	38	68
Efficiency,	34	100	57	74	4
Average,	43	93	70	43	27

I have included efficiency in this table because, as used in the paper, it seemed to have more affiliation here than with energy of will. It will be noted that the table presents only one individual divergence from the curve of health. The series grouped under intellectual capacity follows:

Men.	*D*	*A*	*B*	*C*	*E*
Intellect,	38	90	57	79	49
Quickness,	9	87	57	99	33
Intensity,	57	82	25	76	8
Originality,	66	82	17	84	8
Clearness,	17	90	74	72	45
Average,	37	86	46	82	29

The correlation in this group is less extensive than in the preceding. The same individuals stand at the top and bottom of the list—a pronounced condition of bodily weakness lowers efficiency here as elsewhere—but the series presents much greater individual irregularities. The following traits have been grouped under energy of will:

Men.	*D*	*A*	*B*	*C*	*E*
Will,	63	90	45	49	2
Energy,	77	98	32	90	3
Perseverance,	87	96	30	54	1
Independence,	52	94	57	72	5
Courage,	45	95	52	51	12
Leadership,	6	87	20	17	6
Average,	55	93	39	56	5

In this group of traits the extremes of efficiency are greatest and the falling off which accompanies constitutional weakness most marked. In the lowest of the group it is almost a negligible quantity. *D*'s grade

attains its maximum in this set of will-traits, as we should perhaps expect, yet his physical health suffices only to pull him to the middle of the group. The relatively high attainment of *C*, who is graded 26 in the indices of health, is to be noted. Only two traits seemed to fall naturally into the following group:

Men.	*D*	*A*	*B*	*C*	*E*
Emotion,	26	13	26	24	55
Refinement,	4	52	72	8	63
Average,	15	32	49	16	59

The curve presented here differs strikingly from all which preceded it. It is practically an inversion of the type. With the exception of *C*, in whom mental endowment and moral force have already been found in excess of physical vigor, this reciprocal correlation forms a continuous curve. The remaining traits concern various aspects of social adaptability, and have been grouped under a single head:

Men.	*D*	*A*	*B*	*C*	*E*
Reasonableness,	38	67	93	20	20
Cooperativeness,	38	63	49	19	10
Unselfishness,	45	38	67	10	17
Kindliness,	54	45	82	10	48
Cheerfulness,	34	48	77	34	26
Integrity,	76	96	87	38	38
Average,	47	59	76	22	26

For the first time in the series the maximum is removed downward to the middle of the group. The decline in adaptiveness—social virtues, in other words—is most pronounced in connection with conditions of poor health, but the falling off is important in the other direction also.

As to the significance of these curves, the material is of course altogether inadequate to justify general conclusions, but it is a very interesting fact that the correlation which every one in a way believes in, but would, perhaps, expect to be discernible only in large masses, is presented not only in general, but with characteristic variations even in this small group of individuals chosen at haphazard. If I may assume these five cases as the basis for comments to serve as suggestions for consideration in connection with larger mass of data, the following facts may be noted: Having regard to the main group of four, breadth and sanity of mind, together with executive ability, vary directly with conditions of physical health; but the distribution of original mental endowment, quickness and clearness of grasp, appears independently of its variations. Of all the traits here enumerated the virtues of will—energy, courage, capacity for leadership—fall off most rapidly with extreme degrees of physical weakness; but the efficiency of the individual can not be predicted in the middle ranges of health. The curve of social adaptability reached its maximum in the middle of the group. Reasonableness, unselfishness and the like are apparently not the virtues of the strong; as they are likewise not the marks of a frail or nervously unstable constitution, for which all complex human relations become irksome. If the induction were not based upon so fragmentary a series of observations, one might look upon this curve as indicating the ultimate dependence of sympathy and social integrity upon physical conditions which give rise to a sense of the need of aid, and that these instincts show a decline of intensity in those of rugged strength.

The curve of emotional sensibility and refinement rises with delicacy of constitution, its maximum appearing in the weakest, its minimum in the most robust, member of the group. In connection with this point it may be worth while to observe whether the approach to perfection of physical health is in general—as here—characterized by a more or less marked decline, instead of a continuous rise in general mental efficiency. Without going so far as W. D. Howells, who, in commenting upon Gould's 'Biographic Clinics,' suggests that the ill-health of Carlyle, De-Quincey, Huxley and others might, perhaps, be considered an important factor in their intellectual productiveness, it may well be questioned whether a man is not handicapped rather than favored in regard to mental efficiency by being a perfectly healthy animal. The former functions depend in a peculiar sense upon the development and activeness of the nervous system, the latter upon digestional integrity and adequate nutrition of the muscu-

lar tissues. Mental capacity and vigor may depend upon an upsetting of the physiological balance and the aggrandizement of the central nervous system at the expense of these other processes. Great prosperity in the vegetative functions—which we call physical health—would thus be inimical to the highest intellectual enterprise, and the case of *D* would be made characteristic instead of anomalous. It is at least suggestive that the eupeptic maximum in adults is found in connection with the first stages of general paralysis.

The gist of the figures contained in the table, theorizing apart, is sufficiently indicative of the importance of physical vigor as a condition of mental activity to make the matter worthy of consideration in future study.

Robert MacDougall.

New York University.

THE ELECTRON THEORY.

Professor J. J. Thomson in the March number of the *Philosophical Magazine* discusses the theory of the stability of systems of electrons. His conclusion is that a number of electrons constitute a stable system when they are grouped in a series of concentric circular rings, very similar to Saturn's rings, which rotate about a common axis. Stability depends upon two conditions, namely, (*a*) upon a certain minimum angular velocity of rotation of a ring, and (*b*) upon the presence of at least $f(n)$ electrons at or near the center of a ring containing n electrons. Stability increases when the angular velocity increases above the critical value and when the number of internal particles is greater than $f(n)$; $f(n)$ being a definite function of n.

The first part of Professor Thomson's paper is devoted to the establishment of the two conditions of stability (*a*) and (*b*) and the second part of the paper is devoted to the application of these results to the theory of the constitution of the atom. The features of the second part are:

1. A brief discussion of the types of oscillation of systems of electrons and the application of these results to the rationalization of spectra. Professor Thomson goes no farther than to show in a general way that the spectral lines of a given element may be grouped in a number of series of related lines, and that the different chemical elements of a group or family, such as the alkali metals, may have closely related series of lines. This same idea has been advanced by H. Nagaoka, of Tokyo, who promises soon to publish a paper devoted to this method of classifying spectra.

2. A full discussion of the relations between stable systems containing greater and greater numbers of electrons, and the application of these results to the rationalization of Mendeléef's periodic law. In this section of the paper Professor Thomson shows that a system of electrons furnishes a dynamic model which, with increasing numbers of electrons, exhibits properties closely analogous to those remarkable periodic variations of valency of the chemical elements with increasing atomic weight. This constitutes the first suggestion of anything worthy to be called a rational basis of Mendeléef's law, and its importance can scarcely be overestimated. It is, perhaps, the greatest contribution to theoretical physics during a decade. In this section of his paper Professor Thomson discusses the process of chemical combination in terms of his theory and he suggests an explanation of the catalytic action of water and of a metal such as platinum.

3. An application of the fact that the stability of a system of electrons depends upon a certain minimum angular velocity of the electron rings, to the explanation of radioactivity.

It is the purpose of this note merely to call attention to Professor Thomson's paper, which should be carefully read by every student of chemistry, and to give to the reader a sufficiently clear idea of the electron to enable him to fully appreciate Professor Thomson's theory of the structure of the atom.

It is not to be expected, of course, that a new hypothesis should lead at once to anything approaching a completely consistent theory and it may be helpful to readers of Professor Thomson's article to point out the weak points of his theory.

The electron itself, although it has some very definite claims to objective existence, is not an entirely clear idea. The electric stress which radiates from an electron can, indeed, be thought of in mechanical terms, and the manner in which these lines of stress sweep through space when the electron moves, and the way in which they build up a magnetic field by their motion, can be thought of in a precise way, but no one has at present any definite idea of the nucleus of an electron nor of the way in which the nucleus moves. The mechanical analogue outlined below is misleading in this respect in being free from some of the essential difficulties which arise in the electrical case.

Professor Thomson's explanation of zero valency (which is exhibited by such elements as helium, neon, argon, etc.) does not appear quite satisfactory. He represents zero valency as an extremely evanescent and unstable case of monovalency.

I fail to see how, in Professor Thomson's theory, to explain the rise of valency of a given element by twos, for example the rise of valency of nitrogen from 1 to 3 to 5. This mode of rise of valency has suggested to chemists the idea of the neutralization of valency bonds by each other in pairs. However, this difficulty may be met, perhaps, by using the notion of subsidiary groups of electrons.

On the other hand, Professor Thomson's hypothesis, that the atom consists of a number of extremely minute negative electrons moving about in a small spherical region containing uniformly distributed positive charge, meets a fundamental difficulty, namely, that experiment has hitherto failed to give any evidence of the existence of concentrated positive charges corresponding to the excessively concentrated negative charges which constitute cathode rays. In conformity with this hypothesis as to the structure of the atom, the mass of an atom is to be taken as proportional to the number of negative electrons the atom contains, regardless of the extent and value of the distributed positive charge. This is explained later in mechanical terms.

A clear idea of the behavior of a system of electrons depends upon an understanding of the dynamics of a single electron, and the dynamics of an electron is very different from the dynamics of a material particle.

The dynamics of an electron depend primarily upon the fact that kinetic energy is associated with a moving electric charge independently of the 'material' mass of the body upon which the charge resides. That is to say, electric charge has inertia or mass. This association of kinetic energy with an electric charge is a phenomenon of the electric field, not of the charge itself and the mode of association is precisely (not necessarily accurately) understood. Stated in terms of a mechanical analogue, it is as follows: Imagine a great lake of jelly with a mass-less cylinder pressed down upon its surface. Underneath the cylinder the jelly will be under stress and strain and this stress and strain will represent energy, corresponding to the purely electrical energy associated with the electrical stress surrounding a charged body. If this mass-less cylinder be rolled along over the jelly surface the strain figure underneath the cylinder will travel with the cylinder, and each successive portion of the jelly will move as it is twisted into conformity with the approaching strain figure and as it is again twisted into its unstrained condition after the strain figure is passed. *This motion represents kinetic energy corresponding to the magnetic energy of a moving electron, and the strain figure, therefore, has inertia.*

If the cylinder is small in diameter the strain which is associated with it is greatly concentrated and for a given integral amount of stress or strain (given force pushing the cylinder down) a much greater amount of kinetic energy would be associated with a given velocity of the rolling cylinder, inasmuch as the successive portions of the jelly would move with increased velocity as they are twisted into conformity with the approaching strain figure, and as they are again twisted into an unstrained condition after the strain figure has passed. Therefore, a strain figure having a given integral amount of strain has greater and greater inertia the more the strain figure is concentrated. At

velocities which are low as compared with the velocity of wave propagation on the jelly surface the kinetic energy of the moving strain-figure is proportional to the square of its velocity and, therefore, its inertia or mass value is constant. Where the velocity of the strain figure is not very small then the inertia reaction of the moving particles of jelly as they are twisted into and out of the moving strain figure *helps to sustain or hold the strain of the moving figure*. Thus at full wave velocity a strain figure is held wholly by this inertia reaction and no cylinder need be pressed upon the jelly to maintain a strain figure. On the other hand, when the cylinder is pushed down with given force the integral stress increases more and more with increasing velocity, a portion of the stress being sustained by the cylinder and a portion being sustained by the inertia reactions above mentioned. Therefore, with given force on the cylinder the integral stress approaches infinity as the velocity of the cylinder approaches the wave velocity, and corresponding to this increase of integral stress due to given force on cylinder the inertia or mass value of the strain figure increases indefinitely as its velocity approaches the wave velocity.

The inertia or mass value of a given electrical charge (integral value of electric strain) increases as the charge is more and more concentrated, and the inertia or mass value increases with velocity, approaching infinity at the velocity of light. In case of the moving electric charge, however, the increase of mass value due to magnetic reaction (corresponding to inertia reaction in the jelly) does not affect the integral value of the electric strain, but merely concentrates the electric strain more and more into a plane perpendicular to the direction of motion.

A clear picture in two dimensions of an electron may be obtained by imagining massless points to rest with a certain force against a horizontal stretched sheet of rubber, each point producing a deep funnel-like depression. The mass value of each depression for given force pushing the point down is greater and greater the smaller the point.

This picture is, however, incomplete in several respects, notably in that two depressions (two negative charges) attract each other while a depression and an elevation (a positive and a negative charge) repel. This is due to the essential differences between electric stress and any kind of mechanical stress.

A clear picture in two dimensions of a system of negative electrons moving about in a region of distributed positive charge—Professor Thomson's hypothetical atom—may be obtained by imagining a wide and shallow saucer-like depression in a rubber sheet in which a number of point depressions are moving about and held together as a system by the gradient of the saucer-like depression.

Such a system moving as a whole would owe its mass value chiefly to the concentrated point-like depressions, inasmuch as the broad and shallow saucer-like depression would have a negligible mass value, as explained above.

Some striking features of the dynamics of an electron are the following (see paper by M. Abraham, *Ann. der Physik,* January, 1903). These features depend partly upon the above-described increase of mass value of an electron with increasing velocity partly upon the slight delay between a given assumed change of velocity of the electron and the consequent rearrangement of the surrounding electromagnetic field, and partly upon the fact that an *accelerated* electron radiates energy in the form of waves like a steadily moving boat.

The mass value of an electron moving at given velocity as measured by the acceleration produced by a given impressed force varies with the direction of the force, being greatest in the direction of the motion (longitudinal mass) and least at right angles to the direction of the motion (transverse mass). Furthermore, the acceleration is in general not in the direction of the accelerating force; the relation between force and acceleration being represented by the relation between the diameter of a circle (sphere) and the corresponding radii vectores of an ellipse (ellipsoid) in the drawing which is ordinarily made by students to show the projection of a circle into an ellipse (a relation known as the linear-vector-function).

An electron moving uniformly in a circular

orbit has acceleration and radiates energy so that its motion dies away. The dying away of the motion of a circular row or ring of electrons in this way is excessively slow if the number of electrons in the ring is great and if the velocity is small as compared with the velocity of light (see J. J. Thomson, *Phil. Mag.*, December, 1903). In fact, the time required for the angular velocity to fall from a value slightly above the critical value required for stability to the critical value might easily be a matter of millions of years under certain conditions.

It is interesting to note, although perhaps useless, considering the widespread confusion of the fundamental ideas of thermodynamics, that this electron theory, pointing as it does to finite systems which apparently never can settle to thermal equilibrium, suggests a class of phenomena, sensible and *steady* phenomena too, which are on the wrong side of thermodynamics, that is, on the side opposite to mechanics; phenomena which are to be treated by developing a systematic theory of atoms as isolated systems and the subsequent merging of this systematic theory of single atoms into a statistical treatment of aggregates of atoms; but this is another story. W. S. F.

A HEAVY JAPANESE BRAIN.

THROUGH the kindness of my friend, Mrs. Helen H. Gardener, now in Tokio, I am able to publish the following extract from the post-mortem examination of Professor K. Taguchi, the celebrated anatomist, of the College of Medicine in the Tokio Imperial University. His death took place in Yumi-cho, Hongo, on February 4 of this year, and, in accordance with the terms of his will, his body was dissected by his colleagues at the college. Professor Taguchi is perhaps the first of his race to bequeath his body in this manner. His work on the brain-weight of the Japanese has been referred to by the writer in SCIENCE (September 18, 1903). His own brain is the heaviest on record among the Japanese, and in the list of eminent men throughout the world, whose brains have been weighed (107 in number) it occupies second place. Taguchi's brain-weight (1,920 grams or 67.7 oz. avoir.) exceeds the highest recorded Japanese brain-weight by 130 grams (or 4.5 oz.).

"Extract from report of the post-mortem examination of Professor K. Taguchi on February 5, 1904, in the Pathological Institute, Tokio, by Professor Dr. K. Yamagiwa:

"Age, 66 years.

"Body-weight, 49,000 grams.

"Brain-weight, 1,920 grams.

"Clinical diagnosis: Cirrhosis of the kidney.

"Anatomical diagnosis: Hypertrophy with dilatation of the left ventricle of the heart; endocarditis valvularis chronica fibrosa adhæsiva aortica; endocarditis valvularis chronica fibrosa mitralis; œdema pulmonum; hypostatic pneumonia of lower lobe of left lung; nephritis chronica interstitialis; cystic degeneration of the kidney; atheroma in the aorta." EDW. ANTHONY SPITZKA.

PROFESSOR RUTHERFORD ON RADIUM.

PROFESSOR E. RUTHERFORD, of McGill University, lectured before the Royal Institution on May 20, on 'Radiation and Emanation of Radium.' According to the London *Times*, the lecturer first showed the power of radium to excite phosphorescence and to discharge a charged electroscope, and then described the properties of the three kinds of rays which it had been found to give off. In addition it gave off an emanation which behaved like a gas and could be condensed by cold; it could also be secluded in the radium itself, and was liberated when the salt was dissolved in water. This emanation, though exceedingly minute in quantity, possessed three-quarters of the characteristic powers of radium and all its properties. If we could collect a cubic inch of the emanation, the tube that contained it would probably melt, while a few pounds would supply enough energy to drive a ship across the Atlantic, though each of those pounds would require 70 tons of radium to supply it. In regard to the process going on in the emission of the emanation, he advanced the theory that radium was continuously producing it, but that when produced, instead of remaining constant, it was continuously being changed into something else. He supposed that some atoms of the radium in some conditions be-

came unstable; then there was an explosion, and particles of matter were shot off at great velocities. There was a series of such explosions, due to atomic, not molecular, changes, and resulting in the formation of a series of transition elements. A mass of radium left to itself must therefore throw itself away; probably in about 2,000 years its radio-activity would fall to half value, and after 50,000 years it would cease to exist. It was therefore to be supposed, since radium was produced from minerals more than 50,000 years old, that it was being itself produced from something else, and was itself a transition element. A year ago to find evidence for this point of view did not seem a very promising task, but since then a great deal had been done. In the self-destruction of radium two things must be produced that were not radio-active—the α-ray and the final product. Now helium was always found associated with radium-minerals, and the suggestion that that gas was one of the products had been confirmed by Sir William Ramsay, who had shown that the emanation was able to produce helium from itself. Here there was apparently a definite case of transmutation, though not precisely of the kind sought after by the alchemists, but there was no evidence as yet that matter in general, apart from the radio-active bodies, was undergoing changes of this nature. Radium was distributed very widely over the earth; in fact, was present everywhere, though in exceedingly minute quantities. The question was thus suggested —How much heat were these minute quantities of radium able to provide, and could they account for the gradual increase of temperature found as we went deeper into the earth? The lecturer himself believed that the amount of radium present, uniformly distributed, would be sufficient to account for all the heat lost from the earth and would explain the temperature-gradient as measured to-day. In that case the date, as calculated by Lord Kelvin, when this globe would have so far cooled as to be uninhabitable might possibly be postponed for a few million years, and an end put to the troubles of the biologists and geologist about a little extra time in the past.

SCIENTIFIC NOTES AND NEWS.

The International Association of Academies met at London at the end of May as the guest of the Royal Society and the British Academy. The National Academy was represented only by its British foreign members. No information concerning the scientific work of the association appears to have been made public.

At a recent meeting of the Board of Managers of the New York Botanical Garden, Dr. D. T. MacDougal was advanced from the post of director of the laboratories to that of assistant director of the institution. Dr. W. A. Murrill was appointed assistant curator in charge of the fungi to take the place of Professor F. S. Earle, who recently resigned to take the position of director of the Estacion Agronomica of Cuba.

Dr. E. L. Greene, head of the Department of Botany of the Catholic University of America, has resigned to accept a position in the Smithsonian Institution.

Sir William Ramsay was elected an honorary member of the Bunsen Gesellschaft, at the recent meeting in Bonn.

Sir William Huggins has been elected an honorary member of the Royal Philosophical Society of Glasgow.

M. Bigourdan has been elected a member of the Paris Academy of Sciences in the section for astronomy.

Dr. E. Strasburger, professor of botany at Bonn, has been elected a foreign member of the Academy of Sciences at Christiania.

The New York *Evening Post* states that Professor Henry R. Mussey, of the University of Pennsylvania, has been engaged by the Carnegie Institution to make a special study of the iron industry in the United States.

Dr. H. Austin Aikins, professor of philosophy in Western Reserve University, has sailed for Europe on leave of absence for the coming year.

Mr. and Mrs. T. D. A. Cockerell will spend the summer in England; upon their return to

Colorado in September, Mrs. Cockerell will take the position of teacher of biology and physiography in the State Preparatory School at Boulder. In this work she will be assisted by Mr. Cockerell, who will also conduct a research laboratory in the University of Colorado.

Professor T. Steinmann has returned to Freiburg from geological and paleontological explorations in Bolivia.

Foreign papers report that Dr. Gottfried Merzbacher, who has been engaged for two years on a scientific expedition in the Thianshan Mountains, in Central Asia, has returned to Munich with many objects of geological, paleontological, zoological and botanical interest.

It is reported that Lieutenant Peary has chartered the sealer *Eagle,* at St. John's, Newfoundland, for a cruise to Littleton Island, from July to September, in preparation for a four years' stay in the Arctic regions.

Dr. Alës Hrdlicka, of the U. S. National Museum, has been elected a corresponding member of the Czecho-Slavonic Ethnological Society of Prague.

Dr. Burton E. Livingston, assistant in the Department of Botany, of the University of Chicago, has been awarded the Walker prize by the Boston Society of Natural History for a paper on 'Ionic Stimulation in Plants.'

The Council of the Geological Society of London has awarded the Daniel Pidgeon fund to Mr. Lindsdall Richardson.

Mr. Percy Wilson, administrative assistant in the New York Botanical Garden, has accepted the position of assistant botanist of the Estacion Agronomica of Cuba. Mr. W. T. Horne, fellow in botany in Columbia University, has been appointed assistant pathologist in the same institution.

The Rede lecture at Cambridge will be delivered on June 11, by Dr. J. A. Ewing, F.R.S., upon 'The Structure of Metals.'

We learn from *Nature* that a mathematical society of Vienna has been organized, the meetings of which are to be held monthly. The officers are Messrs. G. von Escherich (president), E. Müller and W. Wirtinger (vice-president), A. Lampa (secretary), and A. Gerstel (treasurer).

The death is announced of Senator Gaetano Georgio Gemmellaro, the Italian geologist; of Professor Lengemann, who held the chair of mining in the Technical Institute at Aachen, and of Mr. Frank Rutley, the British geologist.

The Weights and Measures (metric system) Bill before the British parliament has been read a third time and passed by the House of Lords.

The Chicago Academy of Sciences has secured the collection of Lower Coal Measure plants made by Dr. John H. Britts, of Clinton, Iowa. The collection contains many species, named by Lesquereux, besides numerous cotypes of species, described by David White in Monograph 37, U. S. Geological Survey, on the 'Fossil Flora of the Lower Coal Measures of Missouri.' The collection was obtained through the generosity of Mr. Francis S. Peabody, of Chicago.

Five hundred mechanical engineers, representing the United States and foreign countries, were present on May 31 at the opening of the forty-ninth annual meeting of the American Society of Mechanical Engineers, which was a joint meeting with the Institution of Mechanical Engineers of Great Britain. Addresses were made by Mr. Ambrose Swasey, president of the American society, and Mr. J. P. Hartley Wicksteed, president of the English organization.

The Philadelphia Botanical Club and the Torrey Botanical Club will hold a joint field meeting at McCall's Ferry, Pennsylvania, in the valley of the Susquehanna River, July 2 to 9, 1904, which all botanists are cordially invited to attend. Excursions will be made from this point as a center, to points in the vicinity, returning each day; botanists can, therefore, conveniently take part in the meeting by arriving at McCall's Ferry any afternoon during the week. Informal evening conferences will be held for the discussion of topics that may be brought forward. Fares to McCall's Ferry are as follows:

Philadelphia to McCall's Ferry and return..$3.36
New York to McCall's Ferry and return.... 6.96
Washington to McCall's Ferry and return... 4.06
Hotel charges at McCall's Ferry are $1.25 per day.
Guides: Messrs. Stewardson Brown and Jos. Crawford.

AN International Maritime Congress was held at Lisbon in the hall of the Geographical Society from the twenty-second to the twenty-eighth of May. The program of subjects was as follows:

I. *Oceanography and Hydrography.*—Bathymetric charts. Last cruise of the Princess Alice yacht. Lithobiologic charts. Unification of the scale of marine charts.

II. *Meteorology.*—The north Atlantic and forecasts of the weather in Western Europe.

III. *Territorial Waters.*

IV. *Congresses and Conferences.*—Summary of the work relative to maritime questions.

V. *Institutions for assistance to seamen.*

VI. *International maritime statistics.*

VII. *Panama interoceanic canal.*

VIII. *International Maritime Union Convention.*—Concordant measurement. Load line. Quay dues on the net or the gross tonnage. Lanes for ship routes. Signals in fogs at sea. Navigation rules. The prevention of collisions. Organization for life saving on board. Lighting and buoying of coasts. Condemnation of ships by experts. General average. Non liability clauses in Bills of Lading.

IX. *Yachting.*—International unification of measurement and rules for racing. Decimalization applied to navigation.

X. *Sea Fishing.*—Steam trawlers. The sardine question.

XI. *Wireless telegraphs and telephones.*

XII. *Port improvements and manutention.*

The International Maritime Association, under whose auspices this congress was held has a permanent office at 3 rue des Mathurins, Paris.

THE captain of the ship *Godthaab,* which arrived from Greenland, at Copenhagen, on May 24, reports that the Danish Polar Expedition, led by the author Mylius Erichsen, left Saunders Island, where the explorers had lived for a long time among the Eskimo in the native fashion, on January 20, and, traveling by sledges, safely reached Upernivik, in West Greenland. Afterwards they proceeded to Umanak. The expedition will probably come home in the autumn.

Nature states that a series of prizes is offered by the mathematical and natural science section of the Jablonow Society of Leipzig for themes connected with the following subjects: For 1904, the chemical differentiation of rock magmas; for 1905, the causes of plasmic currents in vegetable cells; for 1906, the analogues of Bernouilli's numbers in the study of elliptic functions; and for 1907, the laws of photoelectric currents. Full particulars are obtainable from the secretary, Professor Wilhelm Scheibner, 8 Schletterstrasse, Leipzig. The Royal Academy of Sciences of Madrid offers for 1905 a prize for the best essay written in Spanish or Latin on the following subject: 'A complete study of a special class of singular integrals arising from differential equations for which the values of the derived functions become indeterminate when certain relations exist between the simultaneous values of the principal variables.'

THE *Monthly Weather Review* reports that by the joint efforts of the Italian Alpenverein, the Duke of Abruzzi, the Minister of Agriculture for Italy, and Queen Margarhita, a geophysical observatory on the summit of Monta Rosa, at an altitude of 4,560 meters, has been erected. It is the highest in Europe, except that of Vallot, on Mont Blanc, and higher than the station on Pike's Peak formerly occupied by the Weather Bureau. The regular observational activity will begin this summer. It will be occupied in the winter time as well as in the summer if the severity of the weather does not prevent. Both the observatory and the hut of refuge for mountaineers will be accessible, not only to Italian but to foreign students who wish to carry on geophysical investigations. The meteorological observations are expected to be of especial importance in connection with the simultaneous international balloon ascensions. Italy now possesses three mountain observatories, namely, Monta Rosa, 4,560 meters; Ætna, 2,942 meters; Cimone, 2,162 meters.

Nature says of the late Professor His: "Professor Wilhelm His, whose death was announced from Leipzig on May 1, at the age of seventy-three, altered and extended our knowledge of human anatomy more than any

man of his time. He discovered and wrote the history of the human body during the first and second months of conception, and thus filled in what, until his time, was almost a blank. He introduced more accurate methods of studying the form and relationships of the various organs of the body. Pupils went to him from all parts of the earth and carried back to their native universities the quiet, honest spirit of investigation, the complete methods and the accurate technique His had introduced in his laboratory at Leipzig. His influence to-day is world-wide; it is especially evident in the remarkable progress in embryological research made recently in the United States. As His entered to lecture one was struck by the absence of those bodily features one expects in a German professor. He was a Swiss by birth and education, having been born at Basel in 1831; in appearance he might have been an Englishman. His narrow, longish head, black hair, regular profile, long sallow face, and nervous temperament indicated his descent from a Celtic stock. He taught quietly, clearly and concisely, illustrating his subject as he spoke by marvelous drawing on the blackboard. He relegated lady-students to the back-bench. Long after the university doors were shut, a light could be seen in the window of his private room, for to him work was also amusement.

THE Cumberland Gap coal field of Kentucky and Tennessee is growing steadily in importance, although most of this area, which forms part of the eastern edge of the Appalachian coal field in southeastern Kentucky and northern Tennessee, is now without transportation facilities. The production of coal from the vicinity of Middlesboro has reached an annual output of from 600,000 to 1,000,000 tons. Bennett Fork has become a mining town for a continuous distance of five miles, and Stony Fork, up which a railroad is just completed, promises soon to become equally active. These and other evidences of rapid development, together with the fact that no government report has ever before been published about Cumberland Gap coals, give especial interest and value to a paper written by Mr. George H. Ashley about this field. This paper is included in a bulletin (No. 225) entitled 'Contributions to Economic Geology, 1903,' recently published by the U. S. Geological Survey for gratuitous distribution. Mr. Ashley's paper is merely a preliminary abstract of a more detailed report, which will be prepared under a cooperative arrangement made between the U. S. Geological Survey and the state of Kentucky. This report will fill several hundred pages and will be fully illustrated with appropriate plates, coal sections and maps.

THE *Journal of Philosophy* summarizes the program for the season of 1904 of the Glenmore Summer School of the Culture Sciences, founded in 1889 by Thomas Davidson. The session will begin on July 11 and extend to September 3. Lectures are announced for Mondays, Tuesdays, Thursdays and Fridays at 11 A.M., and Sundays at 11:30 A.M. There will be informal discussions relative to the subjects of the lectures of each week on Wednesday evenings. The following lectures are announced: weeks beginning July 11 and 18, Charles W. Bakewell, Ph.D., of the University of California, on 'The Philosophy of Plato'; week beginning July 25, Leslie Willis Sprague, lecturer for American University Extension Society, Philadelphia, on 'Ralph Waldo Emerson'; week beginning August 1, Charles G. Child, Ph.D., L.H.D., of the University of Pennsylvania, on 'The Making of English Literature'; week beginning August 8, Hon. Chester Holcombe, A.M., Ex-Minister to China, Lowell Institute Lecturer, 1902, on 'The Religion and Literature of China'; week beginning August 15, Felix Adler, Ph.D., of Columbia University, on 'The General Theory of Social Ethics,' and Edward G. Spaulding, Ph.D., of the College of the City of New York, on 'Dogmas in Philosophy and Science'; week beginning August 22, Alvin S. Johnson, Ph.D., of Columbia University, on 'Some Aspects of the Labor Question'; week beginning August 29, J. Mark Baldwin, Ph.D., LL.D., of Johns Hopkins University, on 'Social Psychology.' There is a possibility that a few additional lectures may be given during the summer by Professor W. T.

Brewster, Ph.D., of Columbia University, and by Professor Lightner Witmer, Ph.D., of the University of Pennsylvania, on literature and psychology respectively. For particulars of the session, Professor Stephen F. Weston, of Yellow Springs, Ohio, should be addressed.

UNIVERSITY AND EDUCATIONAL NEWS.

Mrs. Amanda W. Reed, has provided in her will for the foundation of an institution at Portland, Ore., to be known as Reed Institute, in memory of her husband, the late Simon G. Reed. The bequest will amount to about $2,000,000. Her will specifies that the institute shall combine instruction in the fine arts and sciences and manual training, and that it shall be conducted with especial regard to the needs of young men and women compelled to earn their own living.

President B. I. Wheeler, of the University of California, president of the department of Higher Education of the National Educational Association, has completed the program for the session of the department which is to be held at the St. Louis Exposition on June 29 and July 1. The two subjects chosen for discussion are 'Coeducation in Relation to Other Types of College Education for Women' and 'The Present Tendencies of College Athletics.' The speakers with their subjects include: June 29—President Charles F. Thwing, Western Reserve University, 'The Women's Annex Versus Coeducation'; President Charles W. Dabney, University of Tennessee, 'The Experience of the South in Regard to Coeducation and Other Forms of Education for Women'; President R. H. Jesse, University of Missouri, 'Coeducation as It Has Been Tested in the State Universities'; President G. Stanley Hall, Clark University; President James B. Angell, University of Michigan. July 1—Chancellor E. Benjamin Andrews, University of Nebraska, 'The General Tendency of College Athletics'; President W. H. P. Faunce, Brown University, 'College Athletics'; Chancellor Frank Strong, University of Kansas, 'The Highest Standards of College Athletics—Outright Amateurism.'

The College Entrance Examination Board will hold examinations during the week, June 20 to 25, at about one hundred and fifty points throughout the United States and at London, Paris, Geneva, Strasburg, Dresden and Frankfort. The readers in the sciences are: *Mathematics*—Professor R. W. Prentiss, Rutgers (chief reader); Professor C. E. Biklé, Teachers College; Miss Elsa Bowman, Brearley School; R. H. Bright, Paterson High School, H. H. Denio, Collegiate School; C. S. Forbes, Columbia; J. R. Gardner, Irving School; W. A. Johnson, Hasbrouck Institute; E. H. Koch, Jr., Mackenzie School, Dobbs Ferry, N. Y.; W. E. MacDonald, Massachusetts Institute of Technology; R. Morris, Rutgers, Miss Gertrude Smith, Vassar; Professor Virgil Snyder, Cornell; Miss Roxana H. Vivian, Wellesley; H. E. Webb, Stevens Preparatory School, Hoboken. *Physics*—Professor A. W. Goodspeed, Pennsylvania (chief reader); Professor J. M. Jameson, Pratt Institute; Dr. G. B. Pegram, Columbia. *Chemistry*—Professor J. F. Norris, Massachusetts Institute of Technology (chief reader); Professor C. M. Allen, Pratt Institute; Dr. V. J. Chambers, Columbia. *Botany*—Professor W. W. Rowlee, Cornell (chief reader); Miss Elsie Kupfer, Wadleigh High School. *Geography*—Professor R. E. Dodge, Columbia (chief reader); W. W. Clendennin, Wadleigh High School.

The Rev. Samuel Black McCormick, a Presbyterian clergyman, since 1897 president of Coe College, at Cedar Rapids, Ia., has been elected chancellor of the Western University of Pennsylvania.

Dr. F. G. Donnan, lecturer in chemistry in the Royal College of Science, Dublin, has been elected to the chair of physical chemistry recently founded by Sir John T. Brunner in the University of Liverpool.

At Cambridge Mr. W. J. Sell, F.R.S., and Mr. H. J. H. Fenton, F.R.S., are to be appointed university lecturers in chemistry, and Mr. A. Harker, F.R.S., a university lecturer in petrology.

Dr. O. Aschan has been appointed professor of chemistry in the University of Helsingfors.

Dr. George Landsberg, of Heidelberg, has been called to an associate professorship of mathematics at Strasburg.